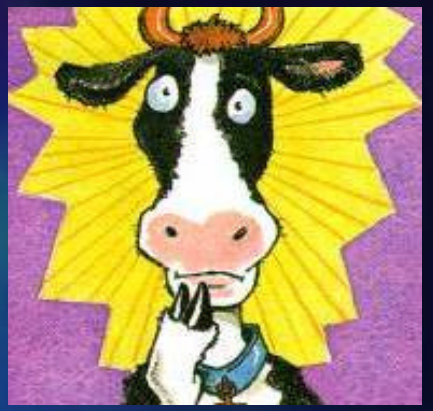
Cow Power:



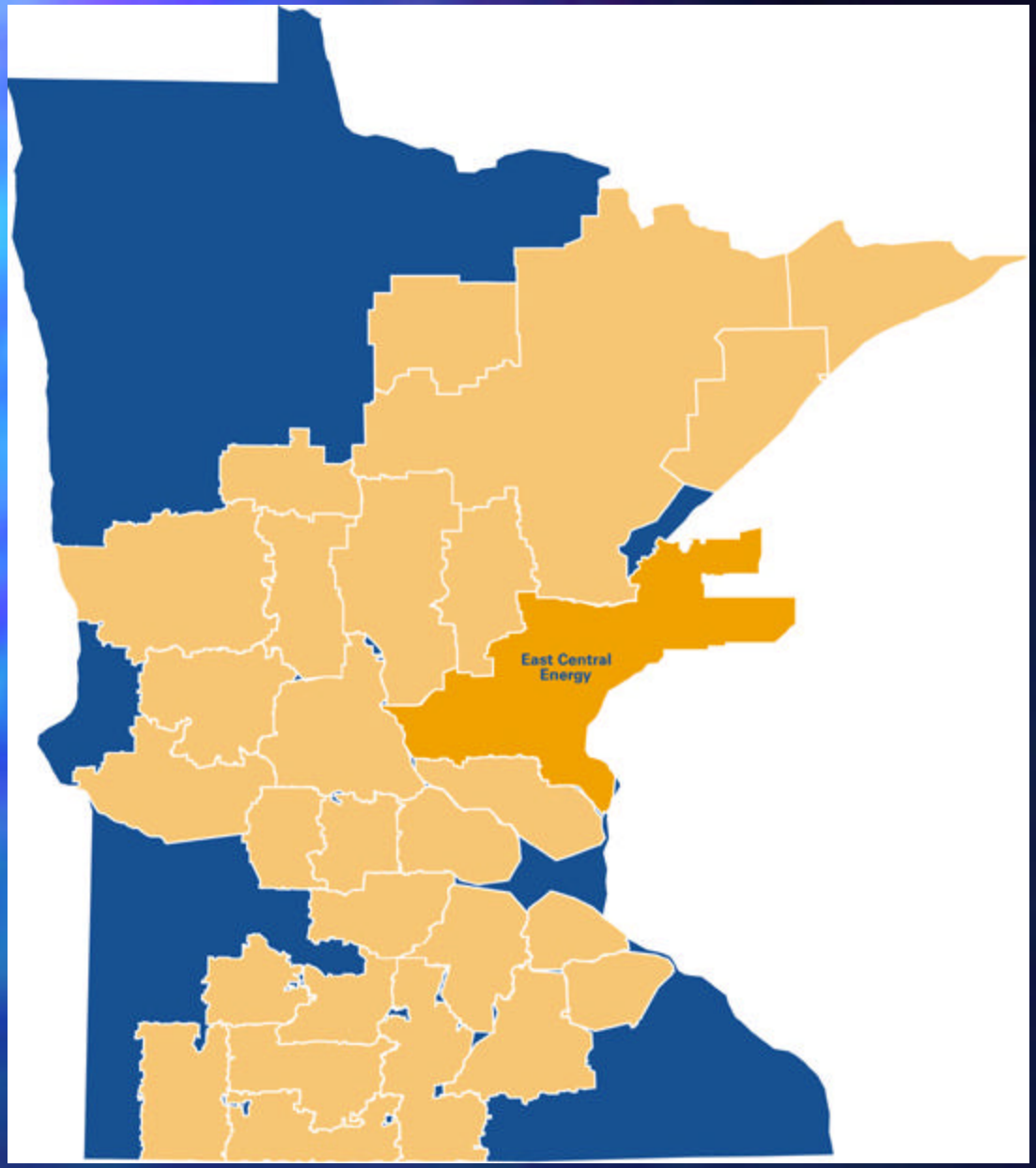
Energizing Agriculture with Renewable Distributed Generation

Henry Fischer
Business and Community Development Manager
East Central Energy
Braham, Minnesota

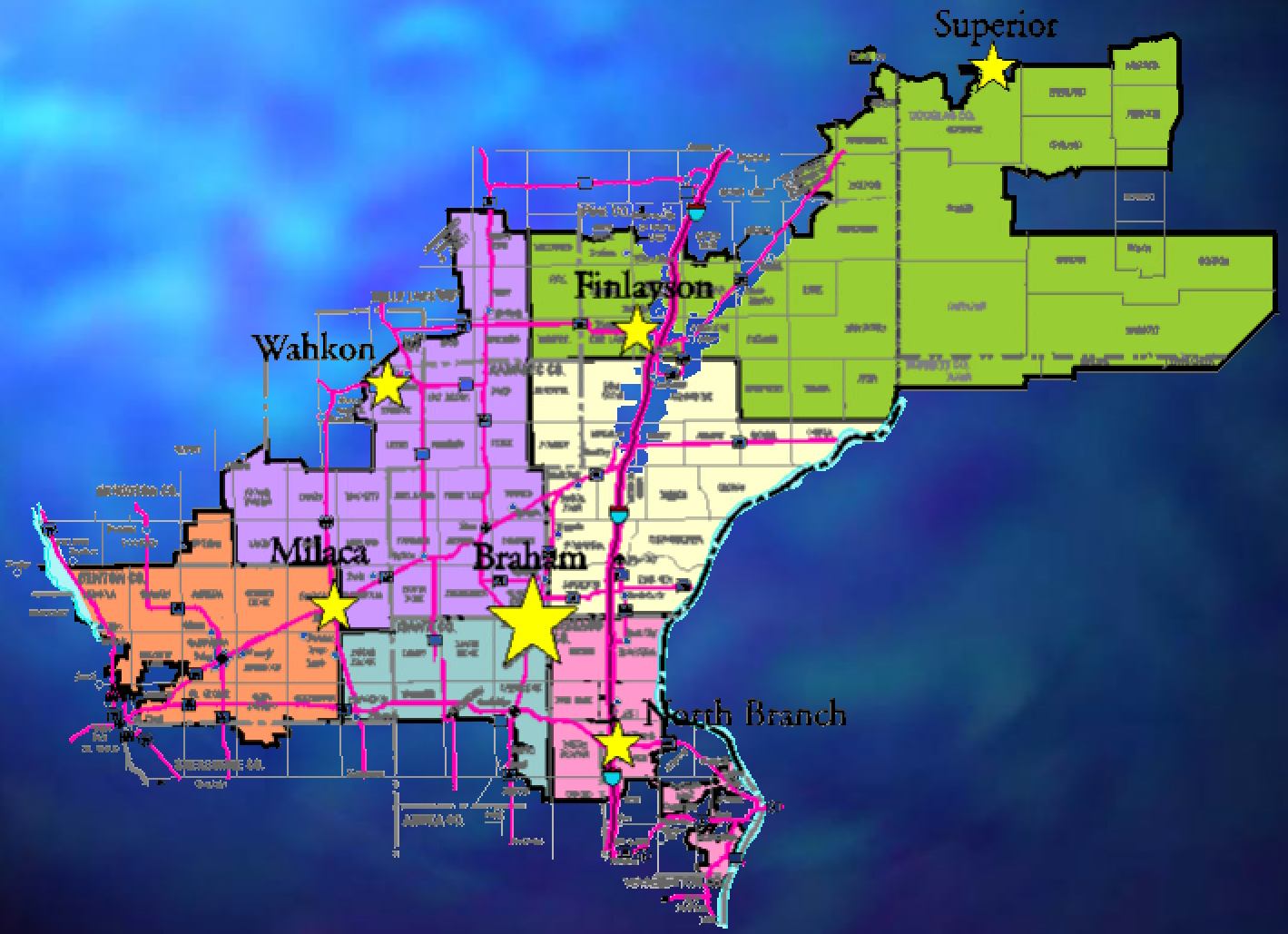
ECE Provides . . .

- *Electric Energy to 52,000 Customers*
- *Propane/Fuel Oil/Natural Gas to 40,000 Como Oil & Propane Customers*
- *Long Distance Phone Service*
- *ECENET Internet to 7,000 Customers*
- *High Speed Internet, Cable TV & Phone Service on a Single Wire*

Great River Energy Family Of 28 Electric Co-ops



East Central Energy Service Area



Touchstone Energy℠

The power of human connections

Customer Focused

East Central Energy

ECE's Business Development Team

Left to Right: Martin Kramer, Larry Breth, Terry Grabau & Henry Fischer

Business and Community Development Department

Under the management of Henry Fischer, East Central Energy's Business and

Our Mission

Enhance the Quality of Life

and

Provide Premier Service

to our Members.

PURPA Requires . . .

- ***Below 40 kW You Must Pay Full Retail***
- ***Over 40 kW You Must Pay "a Minimum of Avoided Cost . . ."***
- ***Least Cost Renewable***
- ***Win-Win-Win-Win-Win***

Minnesota Energy Reliability & Security Act of 2001

- *Make "a good faith effort" to generate or procure at least 1% from renewable energy sources by 2005*
  - *– 10% by 2015.*
- *Of that amount, ½% must be biomass energy by 2010*
  - *-- 1% by 2015.*

Minnesota Energy Reliability & Security Act of 2001

- *Must offer customers one or more options to purchase a certain amount of electricity generated by or purchased from a renewable energy source or from high efficiency, low emissions distributed generation.*
- *Must advertise the offer at least once annually.*

Wind Energy & Biomass

Bill Stuffer

Your Renewable POWER of CHOICE

choice 1 ..... choice 2 .....

WellSpring Renewable Wind Energy:

WELLSPRING
Renewable Wind Energy

WellSpring electricity is produced by cooperative-owned wind turbines in Southwestern Minnesota. The power from existing turbines is currently sold out, but six more will begin producing additional energy during the fall of 2001. ECE is accepting reservations from customers for blocks that will be available later this year.

Biomass Renewable Energy:

The biomass or cow power electricity is produced by using methane to run a generator on a dairy farm near Princeton, Minnesota. The methane is produced in a large domed reservoir where anaerobic bacteria break down organic matter. This system is up and running and you may begin to purchase these blocks on your next bill.

ECE sells renewable energy in 100-kilowatt hour blocks. Both WellSpring and Biomass renewable energy are priced the same at $1.29 per block above our regular rate. For each block you agree to purchase you will see a $1.29 line item charge on your ECE billing statement. Prices may change due to increases in wholesale rates.

You may purchase as many blocks as you wish as long as your minimum monthly billing exceeds the blocks purchased.

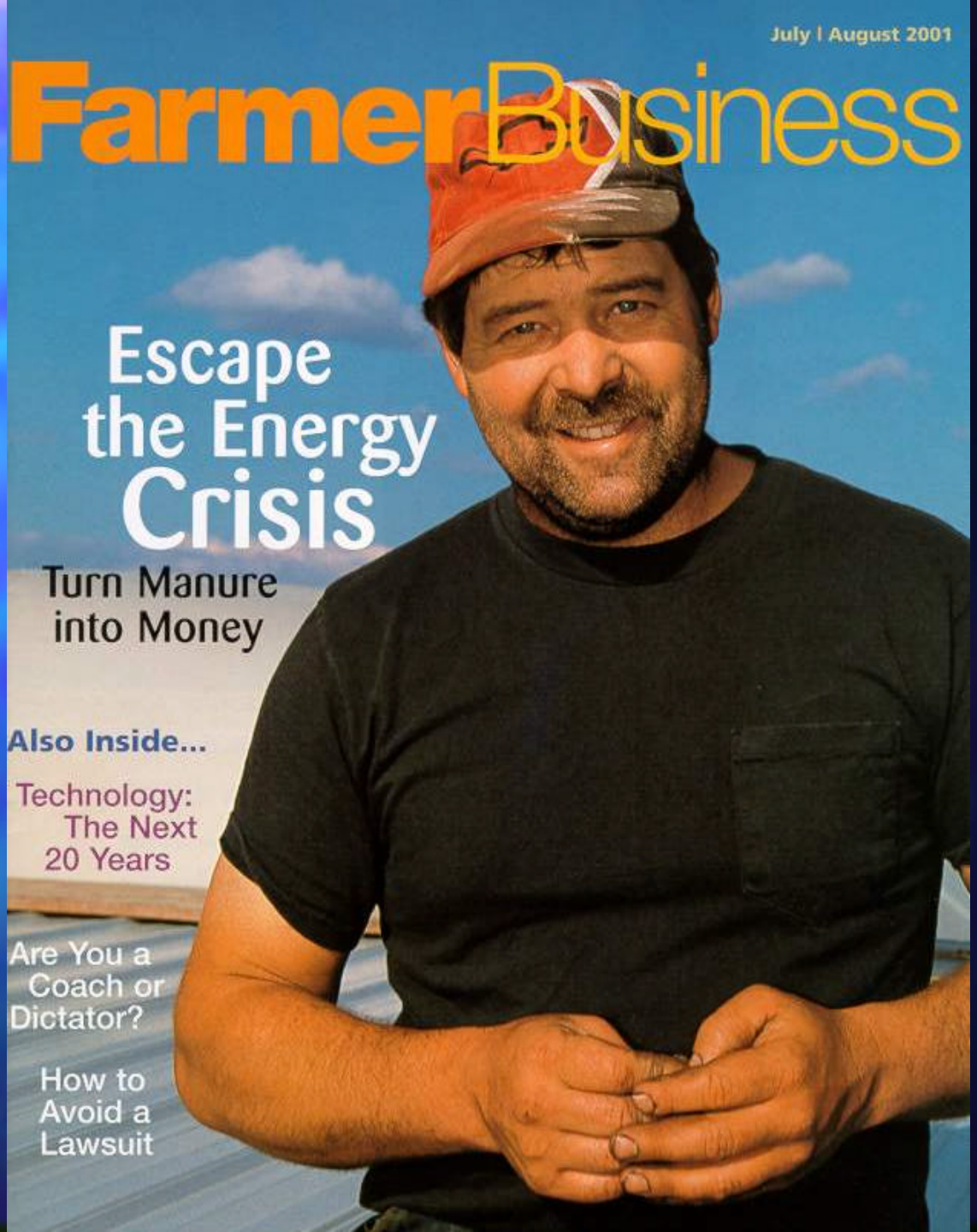
Please fill out and return the Renewable Energy Application Form with your ECE electric bill or mail to:

ECE Renewable Energy
P.O. Box 39
Braham, MN 55006

ECE
EAST CENTRAL ENERGY
Your Touchstone Energy® Cooperative

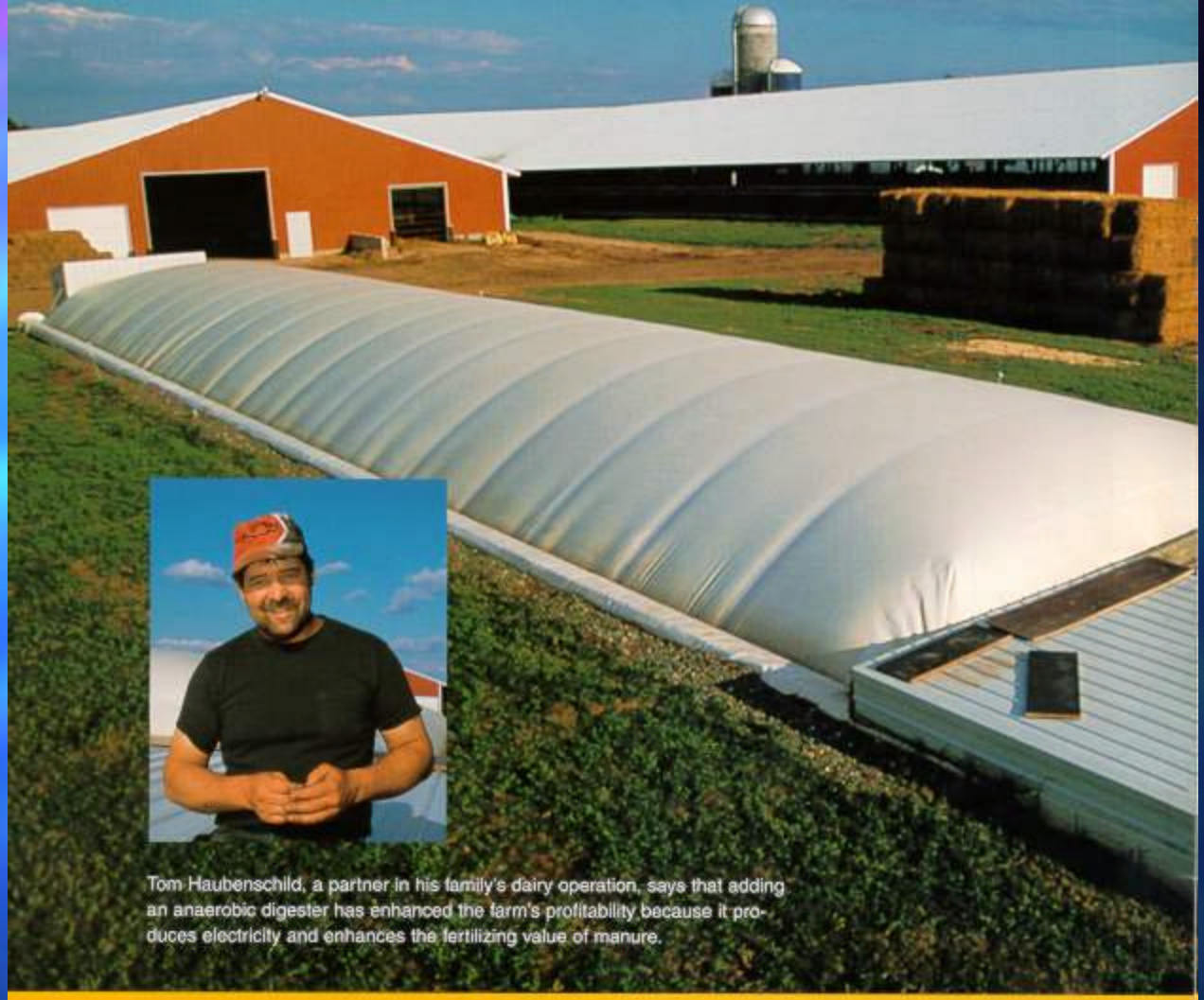
Behold the Power of …

BIOMASS!



Turning Manure into Money

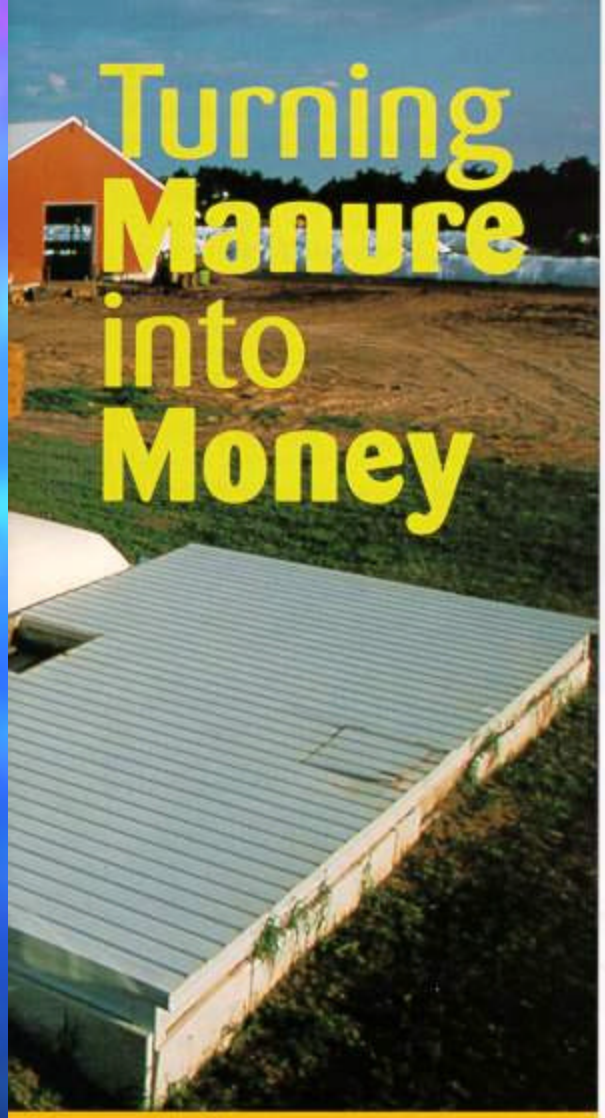
Tom Haubenschild, a partner in his family's dairy operation, says that adding an anaerobic digester has enhanced the farm's profitability because it produces electricity and enhances the fertilizing value of manure.



Tom Haubenschild, a partner in his family's dairy operation, says that adding an anaerobic digester has enhanced the farm's profitability because it produces electricity and enhances the fertilizing value of manure.

Are high electric costs getting you down? Would you like to produce more electricity on your farm than you could possibly use – and then sell it? The Haubenschild family makes their own electricity and turns manure into money.

By Raylene Nickel



Turning Manure into Money

Dennis Haubenschild, a dairy farmer with an educational background in microbiology, has for many years viewed animal manure as a valuable renewable resource. His 800-cow dairy operation near Princeton, Minn., is one of at least 31 dairy and hog farms in the United States that uses an anaerobic digester or similar system to convert manure into electricity. Haubenschild and his wife, Marsha, manage the dairy farm in partnership with their two sons, Tom (age 33) and Bryan (age 30).

The Haubenschilds' digester generates about 100,000 kilowatts of electricity per month. By producing his own electricity, Haubenschild saves close to $700 a week in electric costs. Haubenschild sells the excess — about 60,000 kilowatts, or enough to power 78 homes each month — to his electrical cooperative to use in its renewable energy program. "We sell about $900 worth of electricity per week, year round," says Haubenschild.

"Anaerobic digestion is a beautiful way to harness the energy from cow manure to generate electricity," says Henry Fischer, business and community development manager for East Central Energy, the electric cooperative that buys Haubenschild's excess electricity. "The manure digester is the first of its kind in the upper Midwest. Its reliability has far exceeded our expectations."

Dennis and Marcia Haubenschild estimate that they will break even on the anaerobic digester in about five years.

AG INNOVATION NEWS

The newspaper of the Agricultural Utilization Research Institute

INSIDE:

SPECIAL FOCUS STARTS ON PAGE 4:

FARMING FOR ENERGY

The Energy & Agriculture Relationship

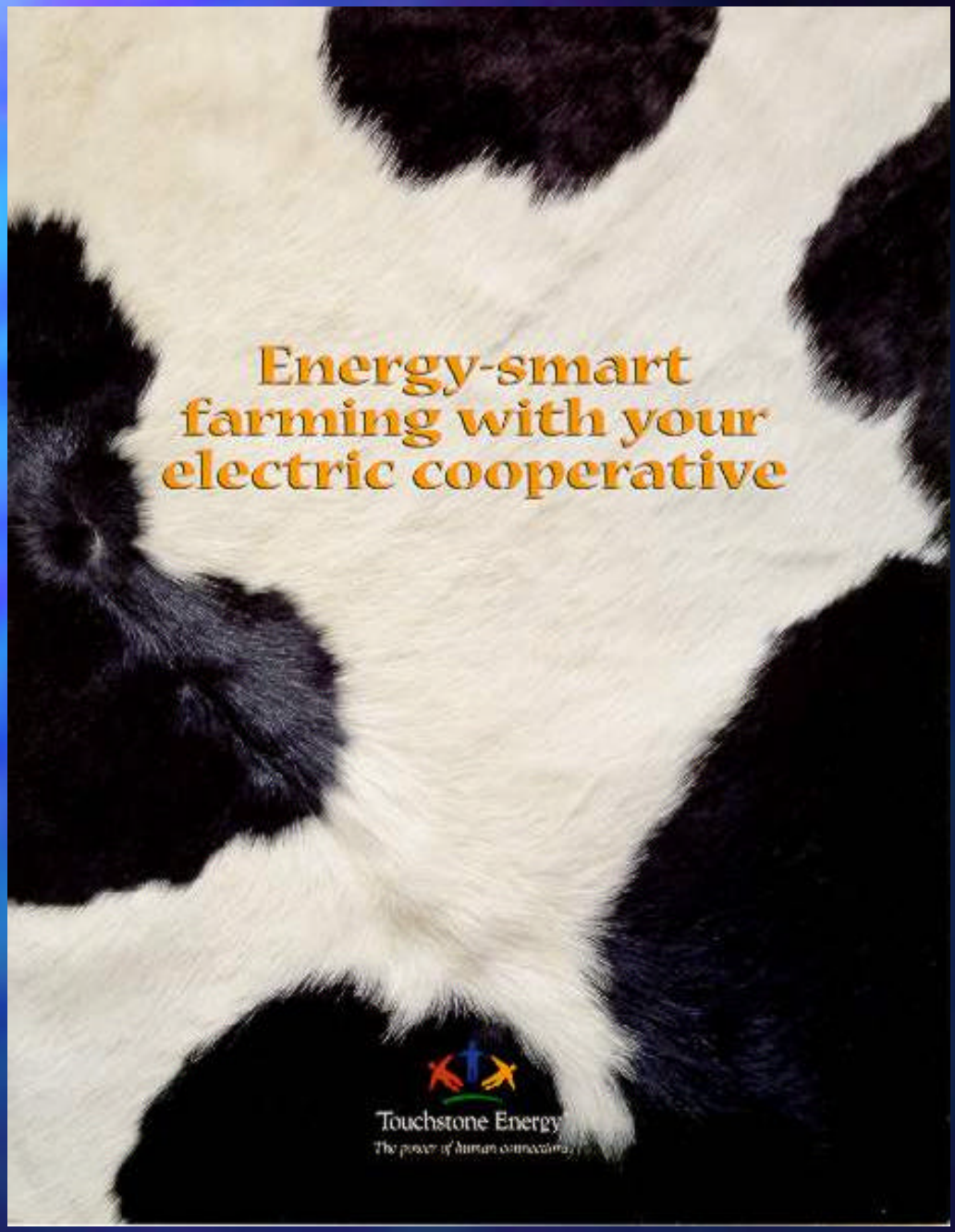
Agriculture could help ease the energy crunch

BY EDGAR OLSON

Not since the mid 1970s has energy been such a hot topic. While we have not had a recurrence of long lines at service stations, in the past few months we have seen the price of gasoline approach or even exceed $2 a gallon. We've also witnessed California residents enduring rolling blackouts. These scenarios renew awareness of our reliance on energy.

Americans consume huge quantities of energy. From dozens of electrical appliances in the home and office to two or more

Promoting Energy Efficiency On The Farm



COW POWER

CHARLES PEALE

East Central Electric Association, a distribution co-op in Braham, Minnesota, will soon be getting power from an unusual source: cow manure. A local dairy farmer is building a huge "methane-biomass recovery system," one of only a dozen in the country and the first in the Midwest. East Central has signed a five-year contract to buy the excess energy.

Microbes break down the manure in the recovery system's "digester," a concrete-lined trench covered with an airtight membrane. Methane gas is released in the process, and it is burned to power a generator.

When the farming operation grows to 1,000 cows, as planned, the expected electrical output will be 100,000 kWh, enough to make the farm energy self-sufficient. East Central anticipates buying 100 kW around the clock at full retail price.

"We have an extensive green power program, so this complements our effort to produce and market energy from renewable sources," says Henry Fischer, manager of business and community development at East Central. He is also enthused about having a member supply renewable energy, which breaks new ground for the co-op.

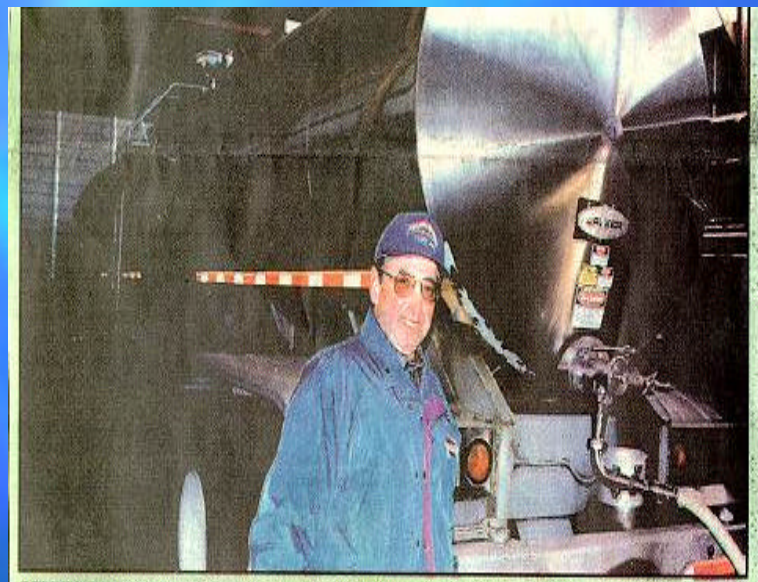
Dennis Haubenschild, who owns the farm with his wife, Marsha, has a track record of keeping the farm "environmentally, socially and economically balanced," as he puts it. East Central has worked with him on other improvements, such as adding four energy-efficient, off-peak electric water heaters.

In addition to electricity, the recovery system creates two by-products: an odor-free slurry that will be used to fertilize Haubenschild's fields and a high-grade compost that will be sold to local garden centers. The expanded dairy operation will create 30 new jobs.

The system is being built with $275,000 in state and federal loans and grants, including assistance from AgSTAR, a program of the U.S. Environmental Protection Agency.

Haubenschild Farm
Princeton, Minnesota

Innovative Family Farm



DENNIS HAUBENSCHILD explains how fluid milk is pumped from the milking parlor into the semi-trailer. The system requires a minimum amount of water. (Photo by Corinne Schunk)

Local farmers turn cow manure into electricity

by Marlys Wickstrom
Contributing writer

The Haubenschild family has a 500-cow dairy farm. Traditionally, large operations have enormous electric bills, but this Isanti County business has a better idea. They don't buy electricity, they sell it.

East Central Energy of Braham (ECE) paid the Haubenschilds almost $9,000 for excess energy produced in the last nine months. The Haubenschilds generated all of the power they needed for their farm with enough kilowatt-hours left over to service 30 average homes.

And they did it with manure.

Five hundred cows produce tons of animal waste, but to Dennis Haubenschild manure is not waste. "Manure is a natural renewable energy resource. Manure is a commodity," he said.

Dennis Haubenschild, his wife Marsha, their sons Bryan and Tom and their families and Dennis's parents Myrtle and Donald own and operate their farm northwest of Cambridge.

Last September Haubenschild Farms installed Minnesota's first biomass power generation project

LOCAL FARMERS
Continued on page 2A

utilizing dairy cow manure. It consists of a manure digester along with an engine and electric generator.

The digester converts the manure into a nearly odor-and pathogen-free slurry that is used to fertilize Haubenschild farm fields. The installation captures air pollutants that normally stink up the surrounding area and converts them into renewable electric power.

"The methane captured by the digester and burned is a powerful greenhouse gas, 21 times more potent than carbon dioxide, the most common gas leading to global warming," said John Lamb of the Minnesota Project, a non-profit organization coordinating an evaluation of the new technology.

Called a "plug-flow digester," its rather simple design uses a concrete-lined trench covered with an airtight membrane. The manure is collected with a scraping system from the barn, but no water is used. The manure is diverted into the digester and stays there for 20 to 40 days. Microbes break down the manure in a process similar to composting, releasing biogas, mostly methane, that is piped to the engine where it generates electricity. The waste heat from the engine is used to heat the digester as well as about 9000 square feet of barn floor. The system is more efficient than the average power plant.

MARSHA HAUBENSCHILD is Dennis' wife and an important member of the team. (Photo by Corrine Schunk)

DENNIS HAUBENSCHILD is the CEO of his family farm operation. (Photo by Corrine Schunk)

Another advantage of the digester is water conservation. All water is used twice, and no water is used for manure collection. The Haubenschilds are environmentalists.

Cows benefit from the new technology too. The heated floor, warmed drinking water, cleanliness, and lack of odor combine to make an ideal environment for the dairy herd. Dennis said that the animals are treated like individuals. Each animal has an identity that is monitored by a state-of-the art computer system in the milking parlor office.

Every 36 hours the herd produces 6,000 gallons of fluid milk that is pumped from the milking parlor into spotless stainless steel semi-trailers.

Milking is done around the clock, seven days a week, by three shifts of 13 full-time-equivalent employees. Dennis said, "Marsha does a work schedule that looks like a crossword puzzle."

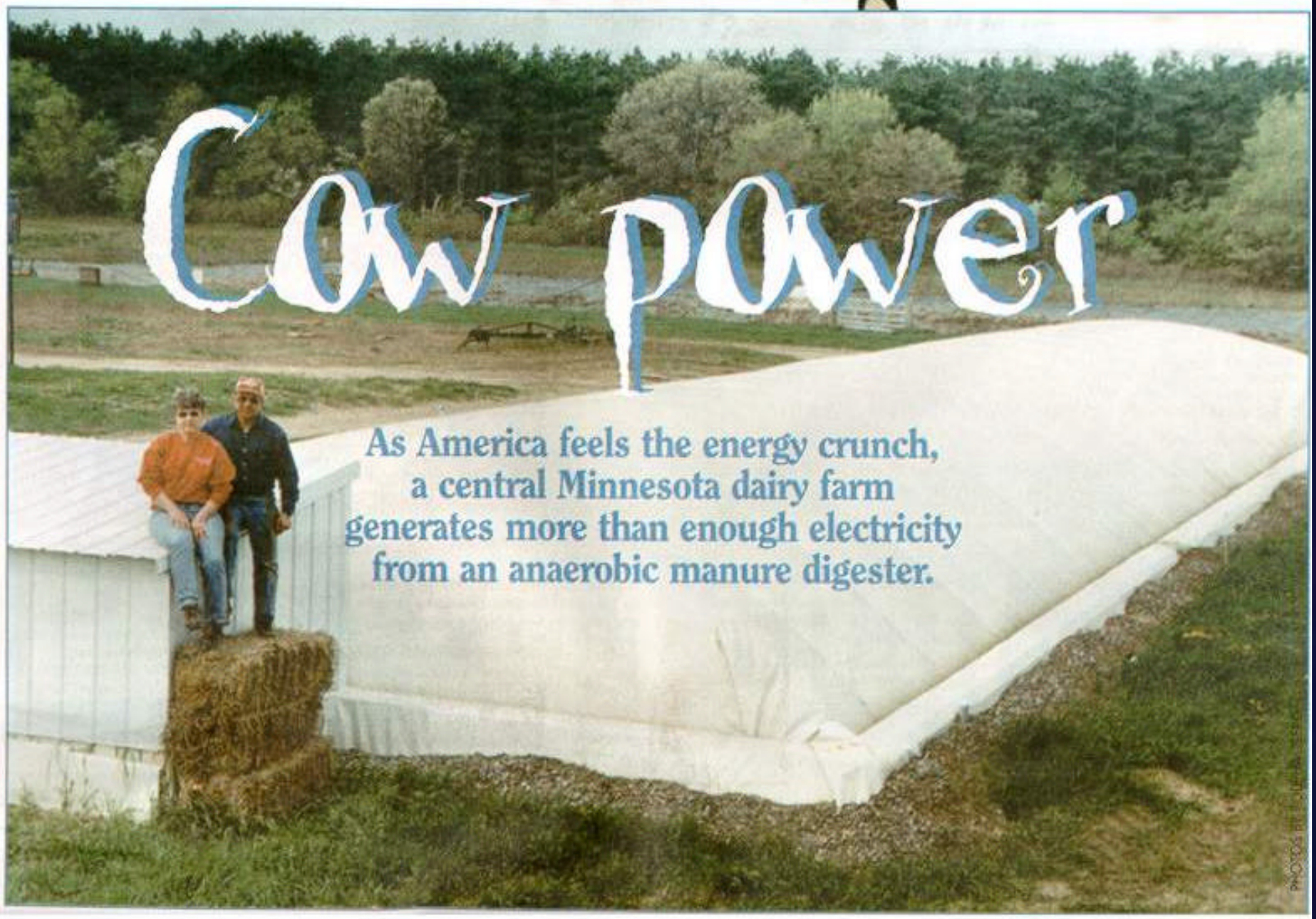
A huge addition to the barn is under construction and will be completed this summer. The addition will house another 500 cows. "We don't plan to add cows to the herd after that. We'll keep it at 1000," Dennis said.

Donald and Myrtle Haubenschild had six cows when they moved from the Owatonna area to Wyanett Township in 1952. Dennis was three years old. When he was growing up Dennis remembers his parents comparing the sandy soil of their Isanti County farm to the rich black soil of southern Minnesota. The visionary Haubenschilds don't think about those differences anymore. All four generations are deeply rooted in Isanti County and want to stay in farming.

Dennis expects to pay back his initial investment in the digester project in five years or less. He credits family members and a number of agencies for the project.

He said if it weren't for ECE, it could not have been done. Other partners are the Minnesota Dept. of Commerce, Minnesota Dept. of Agriculture, University of Minnesota Center for Alternative Plant and Animal Products, Office of Environmental Assistance, Environomics, and AgStar.

MYRTLE, DON, Jill, Bryan and Tom Haubenschild stand in front of the milking parlor. Tom's wife Heather is not pictured. (Photo by Corrine Schunk)

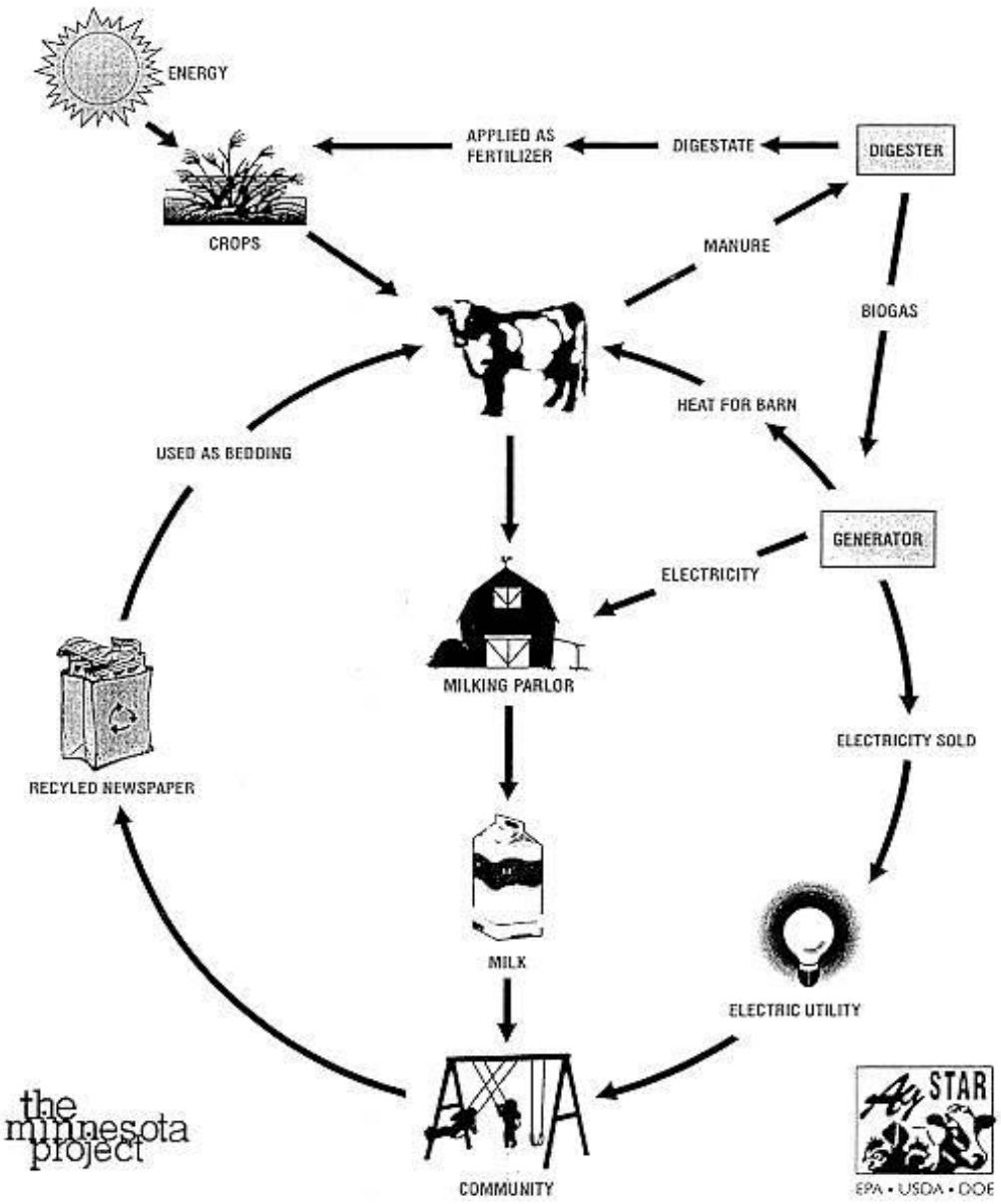


Biogas captured in digester tank on Dennis and Marsha Haubenschild's 760 cow-dairy farm generates 3,000 kilowatt hours of electricity daily, enough to power their farm plus 78 average homes. Digestion also reduces manure odor and creates a high-quality fertilizer.

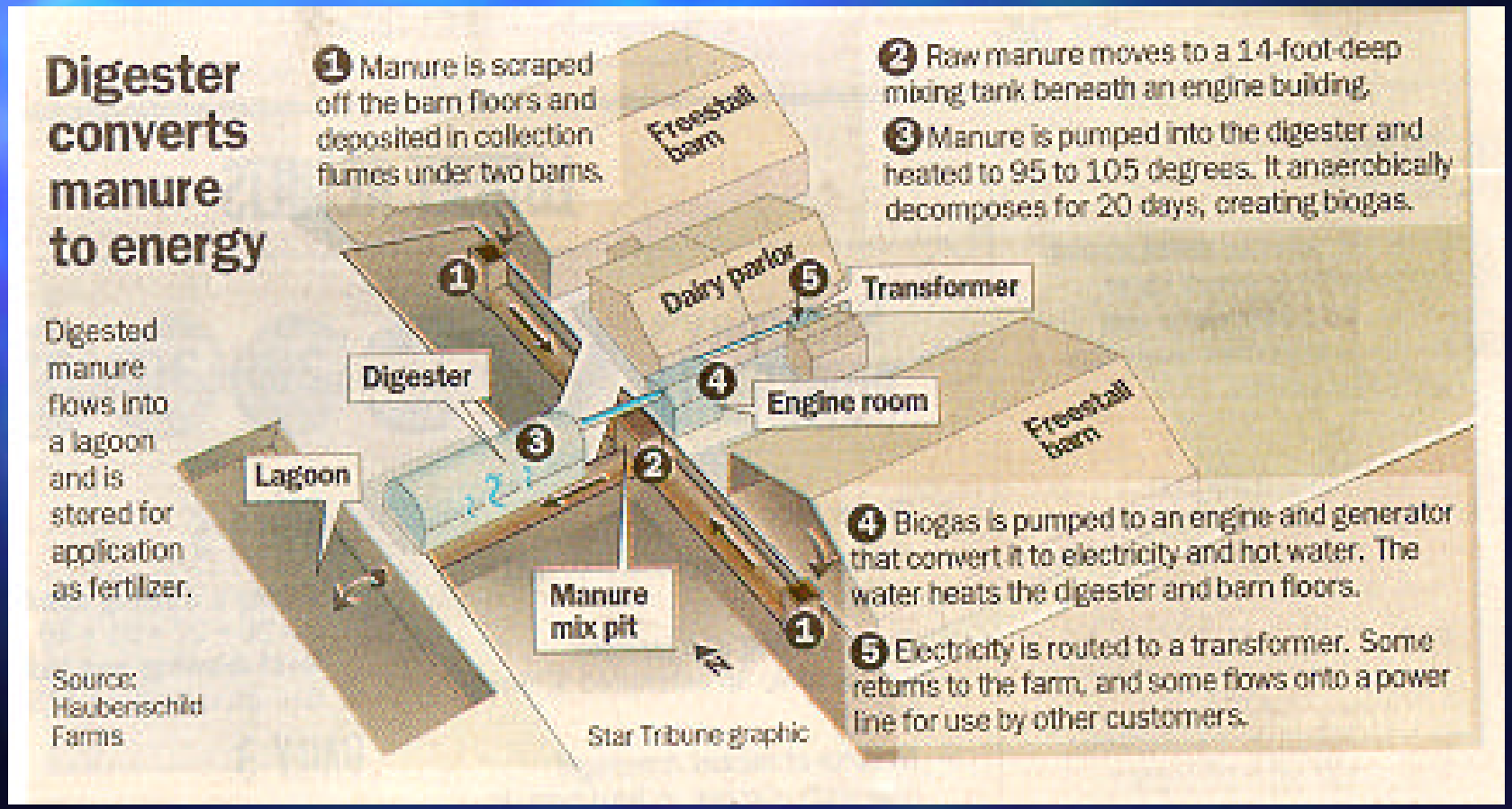
How It Works

Reducing Environmental Impacts: Closing the Loop and Connecting to the Community

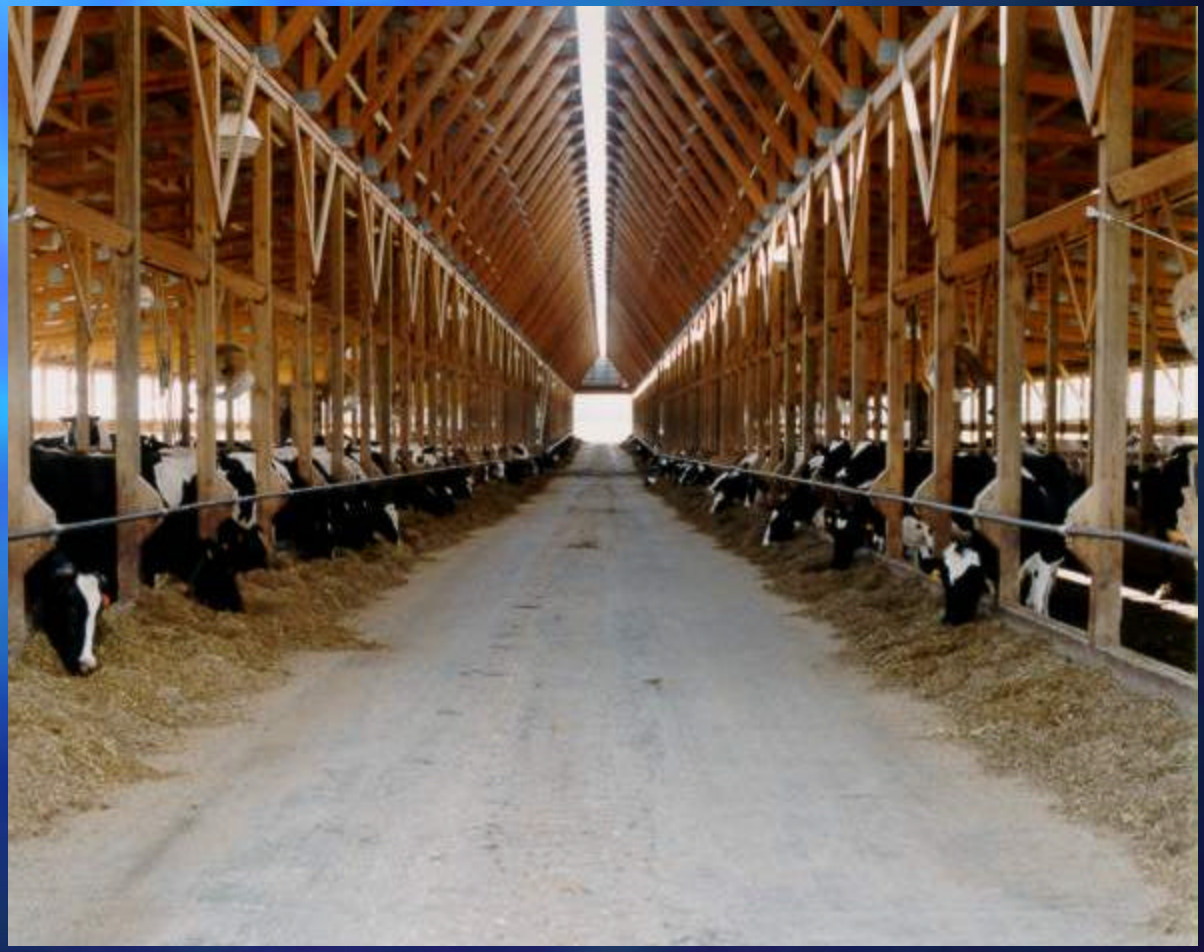
April, 2000



Haubenschild Farm Process



Freestall Barns Utilize Natural, Electric Lighting



Recycled Newsprint Bedding

Milk cows rest in one of the Haubenschild barns on 5-inch mattresses covered with rubber liners and recycled newspaper. The Haubenschilds say keeping their Holsteins contented leads to high production.

Milk = 40 cents/day
Manure = 33 cents/day

THESE COWS AT Haubenschild Farm each eat 90 pounds of food per day and produce enough manure to supply the farm and 80 local homes with electricity. The cows each currently make about 40 cents per day in milk and 33 cents per day in manure. (Photo by Linda Noyce)

1,000 Cows Milked 3 Times/Day

Double 24 Milking Parlor

Electric Water Heaters

Plate Cooler/Heat Exchanger

Electric Chiller

7,200 Gallon Tankers Filled Every 22 Hours

Cheese, Anyone ?

Barn Cleaner/Scraper

Star Tribune photos by David Brewster

Dennis and Marsha Haubenschild with sons Bryan, left, and Tom, derive methane from manure to produce electricity and heat at their dairy farm. The process is seen as one way to help Minnesota become more energy self-reliant. In the dairy barn, above, a scraper draws manure to a pit. The scraper creeps along slowly enough that the cows just step over it.

Slurry Pit

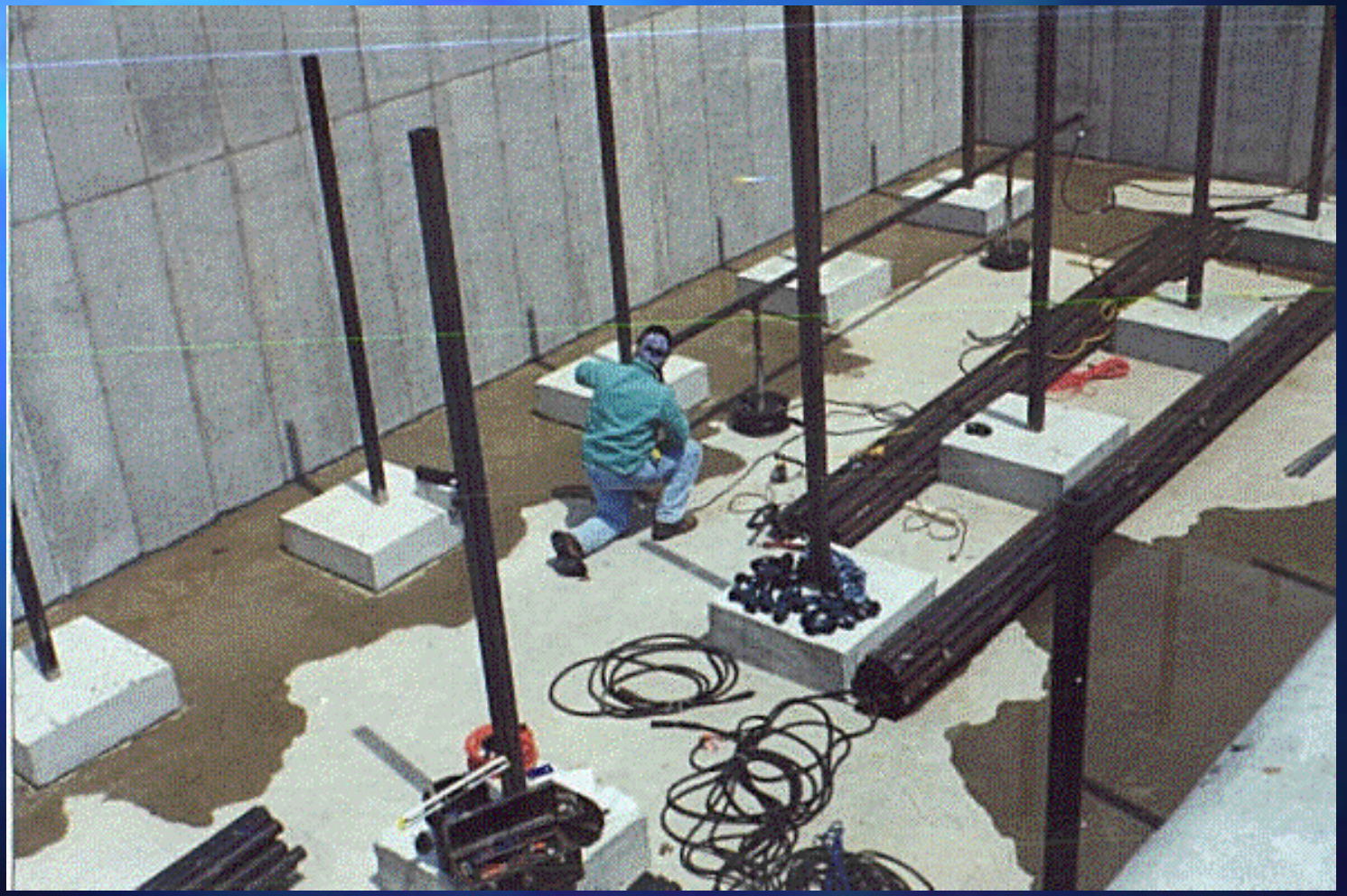
250,000 Gallon Mixing Tank

Anaerobic Digester

Holds 400,000 Gallons of Manure; Each Plug Spends 22 Days

Groundbreaking 4-13-99

Digester Construction



Trench for Methane Pipes

Trench After Rain

Digester in Winter

Liquid Manure Slurry Lagoon

Honey Wagon Injects Liquid Manure into Soil

Generator Enclosure With Hot Water Tank

Pipes from Digester

Biogas Flow Rate Measured

65,000 Cubic Feet of Biogas Produced Each Day

Caterpillar 3406 Generator

Y2K Special
$104,000
Used at
Elk River, MN
Municipal
Landfill

Net Metering

ETS Space & Water Heating

Touchstone Energy®

Top-line solutions, bottom-line benefits

from your local electric cooperative.

Performance Measured Around-the-Clock

Testing, Monitoring Continue

Farm Tours Welcome!

Haubenschild family offers farm tour

Legislators, electric utilities, fellow farmers and the general public were invited to Haubenschild Farms near Princeton last weekend for tours of the family's unique digester system.

The system attracts attention because of its efficiency for producing electricity for not only the farm's needs, but enough leftover for East Central Energy to power additional local homes.

"It has exceeded our expectations," said Henry Fischer, manager of business and community development at ECE, after a tour on April 6.

So how does it work? According to literature provided by the Haubenschilds, the system collects and breaks down manure, capturing methane gas which can be used to produce electricity and hot water for heating.

Haubenschild's dairy cows produce enough methane to generate about 2,000 KWh per day of electricity. The dairy also saves $400 per month in heating costs by using waste heat from the generator.

"Manure is a natural renewable energy resource and we weren't using it to its fullest potential," said Dennis Haubenschild, who operates his farm with his parents Myrtle and Donald, his wife Marsha and sons Bryan and Tom and their families.

Last September, he installed a manure digester, along with an engine and electric generator, to capture this potential.

Producing more power than needed for their operations — when Haubenschild Farms grows from 430 to 1,000 cows as planned — the expected electrical output will be enough to power the farm and about 60 other households.

Viewed as a benefit, the digester converts the manure into a nearly odor and pathogen-free slurry used to fertilize the fields at Haubenschild Farms. "This installation captures air pollutants that would normally stink up the surrounding area and turn them into renewable electric power. For some farmers this may be the way to go," said John Lamb of The Minnesota Project, a nonprofit organization coordinating an evaluation of the new technology.

The digester itself, called the plug-flow digester, is a rather simple design. It's a concrete-lined trench covered with an air-tight membrane. The manure is collected with a scraping system from the barn, but no water is used. It is necessary to have a relatively low liquids content.

Once diverted into the digester, the manure stays there for about 20-40 days. Microbes break down the manure in a process similar to composting, releasing biogas. Mostly consisting of methane, this biogas is then piped to the engine where it generates electricity.

Staff photo by Jon Tatting

Dennis Haubenschild talks with Kurt Roos of AgStar above the manure mix pit and pump and near the heat exchanger.

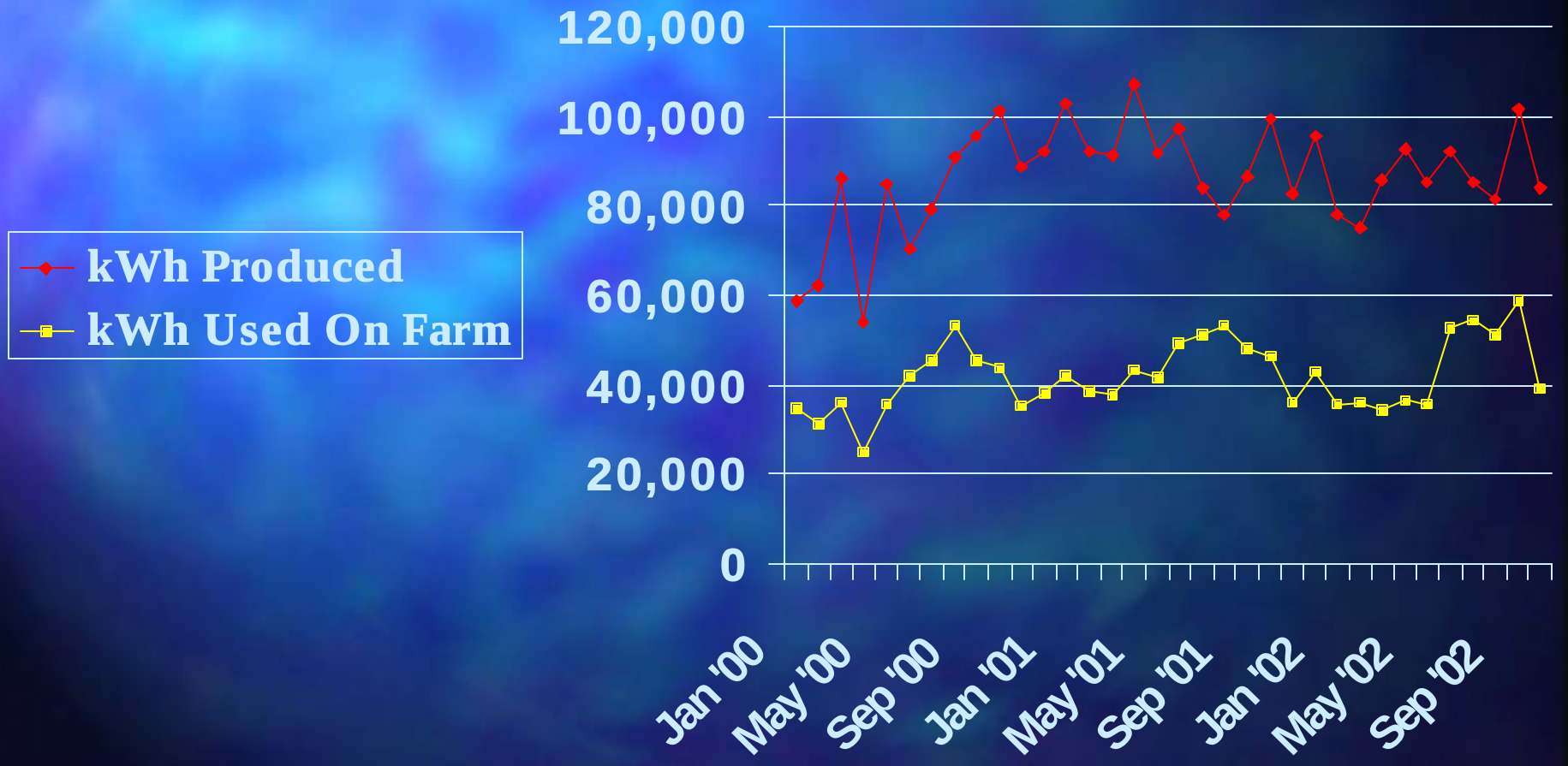
Project Financing

AgSTAR in-kind Engineering	$ 40,000
MN OEA Environmental Grant	37,500
MN Dept. of Commerce Grant	50,000
MN Dept. of Ag. 0% Loan	150,000
Haubenschild Farms Equity	77,500
East Central Energy	0
Financial Investment	**$355,000**

Electric Energy Production

- 133 kW Average Generating Capacity
- 98.7% On-line Availability
- 3,000,280 kWh Produced Since Day 1
- 83,341 kWh Produced Monthly
- 41,310 kWh Used On-farm Monthly
- 42,031 kWh Excess Purchased by East Central Energy Monthly
- Marketed in ECE Renewable Program

Haubenschild Farm Energy Production



Energy Performance

- 139 Cu. Ft. of Biogas/Cow/Day
- 5.5 kWh/Cow/Day = 78 Homes
  or 1 McDonald's
- Customer Saves $3,016/month
  in On-Farm Electricity Costs
- ECE Pays Customer $3,068/month
  for Excess Energy

  ($110,457.76 Since Inception)
- Customer Harnesses Waste Heat to
  Save 4,000 Gallons Propane/Yr.

Environmental Stewardship

Environmental Awards!

Environmentally Friendly Sustainable Agriculture

- Odor Vitually Eliminated (97%)
- Methane Used for Energy Production
- Liquid Slurry Injected into Fields as High Quality Fertilizer
- Solids Become Landscape Quality Compost -- No Weed Seeds, No Flies
- Digestate Sold to Other Farmers
- Waste Heat Warms Floors

Environmentally Friendly Sustainable Agriculture

- Biogas = 70% Methane, 30% CO_2
- 1 Cu. Ft. Methane = 1,000 BTUs
- Methane is 21x More Concentrated than CO_2
- By-Products are Water plus Trace Levels of hydrogen, oxygen, nitrogen, hydrogen sulfide, and CO

Added Value Benefits to Utilities

- Enhances Relationships with State & Federal Agencies, Agriculture, Environmental Organizations
- Avoids Burning 50 tons of Coal per Month (1/2 railroad hopper car)
- Avoids Production of CO_2 Equivalent of 5,000 to 7,000 Tons/Year
- Carbon Tax Credits = 2 cents/kWh
  - Available in the Future

Added Value Benefits to Utilities

- Fulfills ECE Mission & Customer Care Commitment
- Promotes Economic Development
  - 15 New Jobs Created
- Front-Page Publicity in Major Daily Newspapers, Dairy Today, AURI, AgriNews, FarmerBusiness, Energy/Ag Trade Pubs, Websites, Public Radio & Television, National Geographic

Around the World . . .

- *31 Digesters Operating in U.S.A.*
- *13 Ag-Star Projects*
- *450 Digesters in Europe*
- *1 Million Digesters in China and India*
- *Cost Effectiveness Rule of Thumb = 300 Cows @ 6.0 cents/kWh*

What's Next?

- Install 52 KW Stirling Engine Plus 3 KW Fuel Cell to Harness Excess Methane
- Transfer the Technology to More Dairy Farmers
- Elevate Biomass to Renewable Energy Status
- Secure Federal/State Incentives

For More Information . . .

- *www.mnproject.org*
- *www.yosemite.epa.gov*
- *www.epa.gov/agstar*
- *www.mda.state.mn.us*
- *www.hauby@ecenet.com*
- *www.eastcentralenergy.com*
- *www.nfec.org/methanerecovery.htm*
- *www.environomics@waste2profits.com*

...And In Conclusion